

DESCRIPTION

## WATER- AND OIL-REPELLENT COMPOSITION

TECHNICAL FIELD

The present invention relates to a water- and oil-  
5 repellent composition excellent in safety and  
preservation of the environment, which can impart an  
excellent and durable water- and oil-repellency to a  
material to be treated.

BACKGROUND ART

10 Generally, techniques of treating textile goods,  
paper goods or the like with a water- and oil-repellent  
composition to impart a water- and oil-repellency or a  
water- and oil-resistance to their surfaces, are widely  
used in the field of industrial materials including daily  
15 clothing, sports clothing, umbrellas, tents, interior  
goods, wrapping papers or the like.

As a water- and oil-repellent composition, there is  
known an aqueous dispersion having a polymer containing a  
polymerization unit based on a monomer having a  
20 polyfluoroalkyl group (hereinafter referred to as "R<sup>f</sup>  
group") dispersed in water or a mixed solvent of water  
and an organic solvent (hereinafter referred to as  
"aqueous medium").

As a method for preparing such an aqueous dispersion,  
25 there is known a method of emulsion-polymerizing a  
monomer having an R<sup>f</sup> group or a method of emulsion-  
dispersing a polymer containing an R<sup>f</sup> group in an aqueous

medium with an emulsifier. The aqueous dispersion thus obtained is blended with various additives, if desired.

Heretofore, various water- and oil-repellent compositions have been studied and worked to improve water- and oil-repellency, to improve durability to washing or abrasion, and to improve water pressure resistance or oil resistance. Also, various studies have been made to improve applicability to synthetic fibers such as polyester, nylon, acryl or the like, and natural fibers such as cotton, wool, silk or the like, and various proposals have been made with regard to monomers, surfactants, organic solvents, and the like.

Recently, in view of preservation of the environment, safety and health, a water- and oil-repellent composition has been changed from one using an organic solvent to one using an aqueous medium. Also, it is demanded to develop a water- and oil-repellent composition not containing a polymer containing a polymerization unit having a halogen atom (except for a fluorine atom).

Further, from economical viewpoints, it is demanded to develop a water- and oil-repellent composition capable of imparting water- and oil-repellency or water- and oil-resistance in a small amount, a water- and oil-repellent composition capable of achieving a water- and oil-repellent effect at a low heat treatment temperature, and a water- and oil-repellent composition capable of providing a high production yield, which is less

influenced by processing conditions. Also, it is demanded to provide water- and oil-repellent compositions which satisfy various customers' needs. For example, it is demanded to develop a water- and oil-repellent composition excellent in water- and oil-repellent durability at the time of washing with water and drying by a tumbler dryer as a dry cleaning system using water and a domestic tumbler dryer have been spread. In order to improve such a durability, there is widely used a treating method of using a binder such as methylol melamine resin or blocked isocyanate resin and its catalyst in combination with a water- and oil-repellent composition obtained by copolymerizing a (meth)acrylate having an  $R^f$  group with vinyl chloride, vinylidene chloride or the like. However, they are not satisfactory in view of influence of the above-mentioned organic chlorine compound to the environment, complexity of treating method, hard feeling of processed cloth, economical viewpoint or the like.

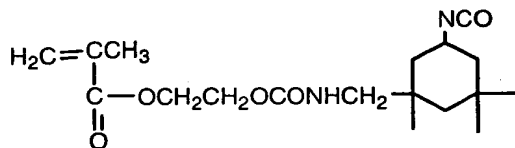
Also, methylol melamine resin is not preferable in view of environmental safety since it generates formalin, and use of blocked isocyanate resin is limited since it makes a treated material yellowish. Further, when using these binders, stability of a diluted solution at the time of processing is lowered and troubles such as settling of resin or contamination of a treated material by generation of a gel-like material are caused.

An object of the present invention is to provide a water- and oil-repellent composition excellent in safety and preservation of the environment and excellent in washing durability.

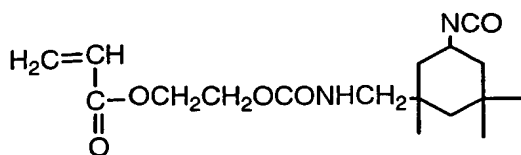
## 5 DISCLOSURE OF THE INVENTION

The present invention provides a water- and oil-repellent composition which comprises (A) the following polymer, (B) an aqueous medium and (C) a surfactant in a mass ratio of (A)/(B)/(C)=100/100-500/1-10:

10 Polymer (A): a copolymer containing (1) a polymerization unit based on a (meth)acrylate having a polyfluoroalkyl group, (2) a polymerization unit based on an alkyl(meth)acrylate having a C<sub>1</sub>-C<sub>12</sub> alkyl group, (3) a polymerization unit based on an alkyl(meth)acrylate  
15 having a C<sub>16</sub>-C<sub>22</sub> alkyl group, and (4) a polymerization unit based on at least one compound selected from the group consisting of 2-isocyanate ethyl methacrylate, 1,3,3-trimethyl-4-isocyanate cyclohexylmethoxymethyl  
20 trimethyl-4-isocyanate cyclohexylmethoxymethyl acrylate of the following formula 2, the isocyanate group of which is blocked:



Formula 1



Formula 2.

### BEST MODE FOR CARRYING OUT THE INVENTION

In the present specification, "acrylate" and "methacrylate" are generally referred to as  
 5 "(meth)acrylate". This expression is the same as in the case of "(meth)acrylamide" and the like.

The polymer (A) in the present invention is a polymer containing a polymerization unit based on (1) a (meth)acrylate ( $a^1$ ) having an  $R^f$  group.

10 The (meth)acrylate having an  $R^f$  group (hereinafter referred to as "monomer  $a^1$ ") is an ester of a (meth)acrylic acid with an alcohol having an  $R^f$  group. The monomer  $a^1$  is preferably a compound expressed by the following formula  $A^{11}$ . In the formula  $A^{11}$ ,  $R^f$  is an  $R^f$   
 15 group, Q is a divalent organic group, and R is a hydrogen atom or a methyl group.



$R^f$  in the formula  $A^{11}$  is preferably an alkyl group in which at least 2 hydrogen atoms are substituted with  
 20 fluorine atoms. The carbon number of  $R^f$  is preferably from 2 to 20, particularly from 6 to 16.  $R^f$  may have a linear structure or a branched structure, but a linear structure is more preferable. In the case of a branched structure, it is preferable to have the branched part  
 25 present at the terminal portion of  $R^f$  and to be a short

chain having a carbon number of about 1 to 4. In the  $R^f$ , an etheric oxygen atom or a thioetheric sulfur atom may be contained. Examples of the terminal part structure of  $R^f$  include  $-CF_2CF_3$ ,  $-CF(CF_3)_2$ ,  $-CF_2H$  and  $-CFH_2$ , and a  
 5 preferable example is  $-CF_2CF_3$ .

The number of a fluorine atom in  $R^f$  is expressed by  $[(\text{fluorine atom number in } R^f)/(\text{hydrogen atom number contained in alkyl group having the same carbon number as } R^f)] \times 100(\%)$ , and the number of a fluorine atom in  $R^f$  is  
 10 preferably at least 60%, more preferably at least 80%, most preferably 100%. When the number of a fluorine atom in  $R^f$  is 100%,  $R^f$  is a perfluoroalkyl group.

The carbon number of a perfluoroalkyl group is preferably from 2 to 20, particularly from 6 to 16. When  
 15 the carbon number of a perfluoroalkyl group is smaller, there is a tendency that water-repellent performance and oil-repellent performance are lowered, and when the carbon number of a perfluoroalkyl group is larger, there is a tendency that handling of its monomer  $a^1$  becomes  
 20 difficult.

Examples of  $R^f$  include  $C_4F_9-$  [such as a group of any isomer structure of  $F(CF_2)_4-$ ,  $(CF_3)_2CFCF_2-$ ,  $(CF_3)_3C-$ , or  $CF_3CF_2(CF_3)CF-$ ],  $C_5F_{11}-$  [such as  $F(CF_2)_5-$ ],  $C_6F_{13}-$  [such as  $F(CF_2)_6-$ ],  $C_7F_{15}-$  [such as  $F(CF_2)_7-$  or  $(CF_3)_2CF(CF_2)_4-$ ],  
 25  $C_8F_{17}-$  [such as  $F(CF_2)_8-$ ],  $C_9F_{19}-$  [such as  $F(CF_2)_9-$  or  $(CF_3)_2CF(CF_2)_6-$ ],  $C_{10}F_{21}-$  [such as  $F(CF_2)_{10}-$ ],  $C_{12}F_{25}-$  [such as  $F(CF_2)_{12}-$ ],  $C_{13}F_{27}-$  [such as  $(CF_3)_2CF(CF_2)_8-$ ],  $C_{14}$

$F_{2,9}$  - [such as  $F(CF_2)_{14}$  -],  $C_{16}F_{33}$  - [such as  $F(CF_2)_{16}$  -] and the like.

When  $R^f$  as an etheric oxygen atom or a thioetheric sulfur atom, their examples include

5  $F(CF_2)_5 OCF(CF_3) -$ ,  $F[CF(CF_3)CF_2O]_{1 \sim 5} CF(CF_3)CF_2CF_2 -$ ,  
 $F[CF(CF_3)CF_2O]CF(CF_3) -$ ,  $F(CF_2CF_2CF_2O)_{1 \sim 5} CF_2CF_2 -$ ,  $F(CF_2$   
 $CF_2O)_{1 \sim 5} CF_2CF_2 -$ ,  $F(CF_2)_5 SCF(CF_3) -$ ,  $F[CF(CF_3)CF_2S]_{1 \sim 5} CF$   
 $(CF_3)CF_2CF_2 -$ ,  $CF_3CF_2CF_2SCF(CF_3) -$ ,  $F[CF(CF_3)CF_2S]_{1 \sim 5} CF_2$   
 $CF_2 -$ ,  $F(CF_2CF_2CF_2S)_{1 \sim 5} CF_2CF_2 -$ ,  $F(CF_2CF_2S)_{1 \sim 5} CF_2CF_2 -$  and  
 10 the like.

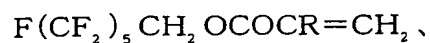
Particularly,  $R^f$  is preferably a linear chain-like perfluoroalkyl group.

Q in the formula a<sup>11</sup> is preferably  $-(CH_2)_{p+q} -$ ,  $-(CH_2)_p CONR^a (CH_2)_q -$ ,  $-(CH_2)_p OCONR^a (CH_2)_q -$ ,  $-(CH_2)_p SO_2 NR^a$   
 15  $(CH_2)_q -$ ,  $-(CH_2)_p NHCONH(CH_2)_q -$ ,  $-(CH_2)_p CH(OH)(CH_2)_q -$ ,  
 $-(CH_2)_p CH(OCOR^a)(CH_2)_q -$  and the like.

In the above formulae,  $R^a$  is a hydrogen atom or an alkyl group, and p and q is independently an integer of at least 0 and p+q is an integer of from 1 to 22.

20 Preferable examples include  $-(CH_2)_{p+q} -$ ,  $-(CH_2)_p CONR^a (CH_2)_q -$  or  $(CH_2)_p SO_2 NR^a (CH_2)_q -$ , wherein q is at least 2 and p+q is from 2 to 6. More preferable examples include an ethylene group, a propylene group, a butylene group, a pentamethylene group or a hexamethylene group.

25 Examples of the monomer a1 include the following compounds, wherein R is a hydrogen atom or a methyl group.



- $\text{F}(\text{CF}_2)_6 \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{H}(\text{CF}_2)_6 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{H}(\text{CF}_2)_8 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{H}(\text{CF}_2)_{10} \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
5  $\text{H}(\text{CF}_2)_8 \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_8 \text{CH}_2 \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_8 \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_{10} \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_{12} \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
10  $\text{F}(\text{CF}_2)_{14} \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_{16} \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $(\text{CF}_3)_2 \text{CF}(\text{CF}_2)_4 \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $(\text{CF}_3)_2 \text{CF}(\text{CF}_2)_6 \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $(\text{CF}_3)_2 \text{CF}(\text{CF}_2)_8 \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
15  $\text{F}(\text{CF}_2)_8 \text{SO}_2 \text{N}(\text{C}_3 \text{H}_7) \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_8 (\text{CH}_2)_4 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_8 \text{SO}_2 \text{N}(\text{CH}_3) \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_8 \text{SO}_2 \text{N}(\text{C}_2 \text{H}_5) \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_8 \text{CONHCH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
20  $(\text{CF}_3)_2 \text{CF}(\text{CF}_2)_5 (\text{CH}_2)_3 \text{OCOCR}=\text{CH}_2$  ,  
 $(\text{CF}_3)_2 \text{CF}(\text{CF}_2)_5 \text{CH}_2 \text{CH}(\text{OCOCH}_3) \text{OCOCR}=\text{CH}_2$  ,  
 $(\text{CF}_3)_2 \text{CF}(\text{CF}_2)_5 \text{CH}_2 \text{CH}(\text{OH}) \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $(\text{CF}_3)_2 \text{CF}(\text{CF}_2)_7 \text{CH}_2 \text{CH}(\text{OH}) \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
 $\text{F}(\text{CF}_2)_9 \text{CH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  ,  
25  $\text{F}(\text{CF}_2)_9 \text{CONHCH}_2 \text{CH}_2 \text{OCOCR}=\text{CH}_2$  .

The polymer (A) of the present invention may contain one or two or more polymerization units based on monomer



a<sup>1</sup>. When the polymer (A) contains at least two polymerization units, it is preferable that the polymerization units are based on monomer a<sup>1</sup> having R<sup>f</sup> respectively having different carbon numbers.

5        In addition to (1) monomer a<sup>1</sup>, the polymer (A) of the present invention contains (2) a polymerization unit based on an alkyl(meth)acrylate (hereinafter referred to as "monomer a<sup>2</sup>") having a C<sub>1</sub>-C<sub>12</sub> alkyl group, (3) a polymerization unit based on an alkyl(meth)acrylate  
10   (hereinafter referred to as "monomer a<sup>3</sup>") having a C<sub>16</sub>-C<sub>22</sub> alkyl group, and (4) a polymerization unit based on at least one compound selected from the group consisting of 2-isocyanate ethyl methacrylate and 1,3,3-trimethyl-4-isocyanate cyclohexylmethyamidoxyethyl(meth)acrylate,  
15   the isocyanate group of which is blocked (hereinafter referred to as "monomer a<sup>4</sup>").

The monomer a<sup>2</sup> is preferably a monomer having one unsaturated bond. The monomer a<sup>2</sup> may be one kind or a combination of two or more kinds.

20        Examples of the monomer a<sup>2</sup> include ethyl(meth)acrylate, propyl(meth)acrylate, butyl(meth)acrylate, isobutyl(meth)acrylate, tert-butyl(meth)acrylate, cyclohexyl(meth)acrylate, 2-ethylhexyl(meth)acrylate, octyl(meth)acrylate,  
25   dodecyl(meth)acrylate, ethylene glycol bis(meth)acrylate, diethylene glycol bis(meth)acrylate, neopentyl glycol bis(meth)acrylate, and the like.

The monomer  $a^3$  is preferably a monomer having one unsaturated bond. The monomer  $a^3$  may be one kind or a combination of two or more kinds. Examples of the monomer  $a^3$  include cetyl(meth)acrylate,  
5 stearyl(meth)acrylate, behenyl(meth)acrylate, and the like.

The monomer  $a^4$  is a monomer having a structure wherein an isocyanate group is blocked. Examples of the compound used for blocking the isocyanate group include  
10 2-butanone oxime, cyclohexanone oxime,  $\epsilon$ -caprolactam, ethyl acetoacetate, acetylacetone, phenol, methanol, dimethyl malonate, bisulfite, pyrazole, 3-methylpyrazole, 3,5-dimethylpyrazole, indazole, and the like.

In view of stability and reactivity, preferable  
15 examples include 2-butanone oxime, ethyl acetoacetate, diethyl malonate, pyrazole, 3-methylpyrazole or 3,5-dimethylpyrazole, and most preferable examples include 2-butanone oxime, 3-methylpyrazole or 3,5-dimethylpyrazole.

In the present invention, the polymer (A) may  
20 further contain a polymerization unit based on other monomer (hereinafter referred to as "monomer  $a^5$ ") in addition to monomer  $a^1$ , monomer  $a^2$ , monomer  $a^3$  and monomer  $a^4$ . Examples of the monomer  $a^5$  include an olefin such as ethylene, propylene, isobutylene or butadiene, a  
25 fluoroolefin such as vinyl fluoride or vinylidene fluoride, an organic acid vinyl ester such as vinyl acetate or the like, styrene,  $\alpha$ -methylstyrene,

(meth)acrylamide, substituted (meth)acrylamide, alkyl vinyl ether, glycidyl(meth)acrylate, aziridinyl(meth)acrylate, hydroxyalkyl(meth)acrylate, polyoxyalkylene glycol mono(meth)acrylate, polyoxyalkylene glycol mono(meth)acrylate monomethyl ether, polyoxyalkylene glycol bis(meth)acrylate, (meth)acrylate having a polydimethylsiloxane group, triallylcyanurate, maleic acid ester, N-substituted aminoalkyl(meth)acrylate, and the like.

Preferable examples include glycidyl(meth)acrylate, hydroxyethyl(meth)acrylate, hydroxypropyl(meth)acrylate, hydroxybutyl(meth)acrylate, polyoxyalkylene glycol mono(meth)acrylate, polyoxyalkylene glycol mono(meth)acrylate monomethyl ether, or polyoxyalkylene glycol bis(meth)acrylate.

A content ratio of each polymerization unit in the polymer (A) is preferably polymerization unit based on monomer  $a^1$ /polymerization unit based on monomer  $a^2$ /polymerization unit based on monomer  $a^3$ /polymerization unit based on monomer  $a^4=40-80/15-40/3-15/2-10$  in a mass ratio. A more preferable content ratio is polymerization unit based on monomer  $a^1$ /polymerization unit based on monomer  $a^2$ /polymerization unit based on monomer  $a^3$ /polymerization unit based on monomer  $a^4=50-70/20-38/4-10/3-8$  in a mass ratio.

When the polymer (A) contains a polymerization unit based on monomer  $a^5$ , a content ratio of each

polymerization unit is preferably polymerization unit  
based on monomer  $a^1$ /polymerization unit based on monomer  
 $a^2$ /polymerization unit based on monomer  $a^3$ /polymerization  
unit based on monomer  $a^4$ /polymerization unit based on  
5 monomer  $a^5=40-80/15-35/5-15/2-10/0.5-10$  in a mass ratio.  
A more preferable content ratio is polymerization unit  
based on monomer  $a^1$ /polymerization unit based on monomer  
 $a^2$ /polymerization unit based on monomer  $a^3$ /polymerization  
unit based on monomer  $a^4$ /polymerization unit based on  
10 monomer  $a^5=50-70/20-38/4-10/3-6/1-5$  in a mass ratio.

The aqueous medium (B) in the present invention is  
preferably water or a mixed solvent of water and a water-  
soluble solvent. Examples of the water-soluble solvent  
include at least one solvent selected from the group  
15 consisting of propylene glycol, dipropylene glycol,  
tripropylene glycol, propylene glycol monomethyl ether,  
propylene glycol monoethyl ether, dipropylene glycol  
monomethyl ether, dipropylene glycol monoethyl ether, and  
tripropylene glycol monomethyl ether. In view of water-  
20 and oil-repellency, preservation stability and safety,  
the aqueous medium (B) is more preferably water or a  
mixed solvent of water with at least one solvent selected  
from the group consisting of propylene glycol,  
dipropylene glycol and tripropylene glycol. In the  
25 water- and oil-repellent composition of the present  
invention, a content of the aqueous medium (B) is  
preferably polymer (A)/aqueous medium (B)=100/100-500 in

a mass ratio. Also, when a water-soluble solvent is contained, a content of the water-soluble content is preferably polymer (A)/water-soluble solvent=100/0.1-50, more preferably 100/10-45, in a mass ratio. When the  
5 content of the water-soluble solvent is too small, freezing stability of emulsion is not satisfactory, and when the content of the water-soluble solvent is too large, it is not preferable in view of stability and preservation of the environment.

10 A surfactant (C) in the present invention is preferably a nonionic surfactant. Also, it is preferable to employ a combination of a nonionic surfactant with a cationic surfactant or an amphoteric surfactant. It is more preferable to employ a combination of a nonionic  
15 surfactant with a cationic surfactant.

The nonionic surfactant is preferably at least one nonionic surfactant selected from the group consisting of the following surfactants c<sup>1</sup> to c<sup>6</sup>.

Surfactant c<sup>1</sup>: polyoxyalkylene monoalkyl ether,  
20 polyoxyalkylene monoalkenyl ether or polyoxyalkylene monoalkapolyenyl ether,

surfactant c<sup>2</sup>: a nonionic surfactant comprising a compound having at least one carbon-carbon triple bond and at least one hydroxyl group in a molecule,

25 surfactant c<sup>3</sup>: a nonionic surfactant comprising a compound having a connection of a polyoxyethylene (hereinafter referred to as POE) chain having at least

two oxyethylene chains continuously connected and a chain having at least two oxyalkylene chains of at least 3 carbon atoms continuously connected, and having hydroxyl groups on both terminals,

5       surfactant  $c^4$ : a nonionic surfactant having an amine oxide group in a molecule,

          surfactant  $c^5$ : a nonionic surfactant comprising a condensate of polyoxyethylene mono(substituted phenyl)ether or polyoxyethylene mono(substituted phenyl) ether, and

10       surfactant  $c^6$ : a nonionic surfactant comprising an aliphatic acid ester of polyol.

          An alkyl group, an alkenyl group or an alkapolyenyl group (hereinafter, all of them are referred to as " $R^c$  group") in the surfactant  $c^1$  has preferably a carbon number of from 4 to 26. The  $R^c$  group is preferably linear chain-like or branched chain-like. As the branched structure, a secondary alkyl group, a secondary alkenyl group or a secondary alkapolyenyl group is

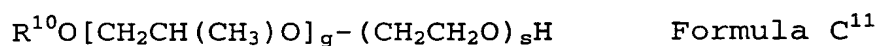
20       preferable.

          Examples of the  $R^c$  group include an octyl group, a dodecyl group, a tetradecyl group, a hexadecyl group, an octadecyl group, a hexadecyl group, a behenyl group (dococyl group), and an oleyl group (9-octadecenyl group).

25       Polyoxyalkylene monoalkyl ether or polyoxyalkylene monoalkenyl ether is more preferable. The  $R^c$  group may be one kind or a combination of two or more kinds.

A polyoxyalkylene (hereinafter referred to as "POA") chain of the surfactant  $c^1$  is preferably a chain having at least two of POE chain and/or polyoxypropylene (hereinafter referred to as "POP") chain connected. The  
 5 POA chain may be one kind or a combination of at least two kinds of POA chains. When the POA chain comprises two kinds, they are preferably block-like connected chains.

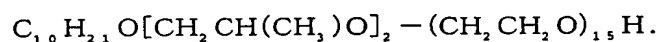
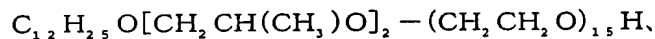
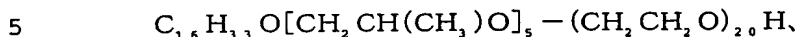
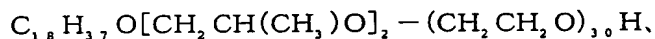
The surfactant  $c^1$  is preferably a compound expressed  
 10 by the following  $C^{11}$ .



In the above formula,  $R^{10}$  is an alkyl group having a carbon number of at least 8 or an alkenyl group having a carbon number of at least 8,  $s$  is an integer of from 5 to  
 15 50, and  $g$  is 0 or an integer of from 1 to 20. When  $g$  and  $s$  are at least 2, a POE chain and a POP chain in the formula  $C^{11}$  are block-like connected. It is preferable that  $C^{10}$  is a straight chain structure or a branched chain structure,  $s$  is an integer of from 10 to 30 and  $g$   
 20 is 0 or an integer of from 1 to 10. When  $s$  is at most 4 or  $g$  is at least 21, it becomes hardly soluble in water and is not uniformly dissolved in an aqueous medium, and therefore permeability of the water- and oil-repellent composition into a material to be treated is lowered.  
 25 When  $s$  is at least 51, water-repellency of the treated material is lowered.

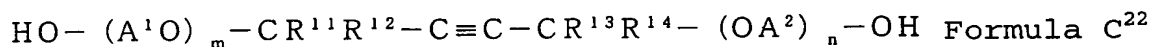
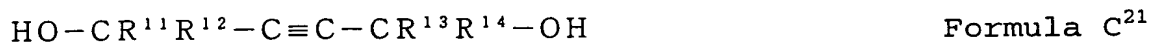
Examples of the compound expressed by the formula  $C^{11}$

include the following compounds, wherein a POE chain and a POP chain are block-like connected.



The surfactant  $c^2$  is preferably a nonionic surfactant  
 10 comprising a carbon having one carbon-carbon triple bond and one or two hydroxyl groups in a molecule. The surfactant  $c^2$  may have a POA chain in a molecule. Examples of the POA chain include a POE chain, a POP chain, a chain having a POE chain and a POP chain  
 15 randomly connected, or a chain having a POE chain and a POP chain block-like connected.

Preferable examples of the surfactant  $c^2$  include compounds expressed by the following formula  $C^{21}$ ,  $C^{22}$ ,  $C^{23}$  or  $C^{24}$ .



20 In the above formulae,  $A^1$ ,  $A^2$  and  $A^3$  are respectively independently an alkylene group,  $m$  and  $n$  are respectively an integer of 0 or higher,  $(m+n)$  is an integer of at least 1, and  $k$  is an integer of at least 1. When  $m$ ,  $n$  or

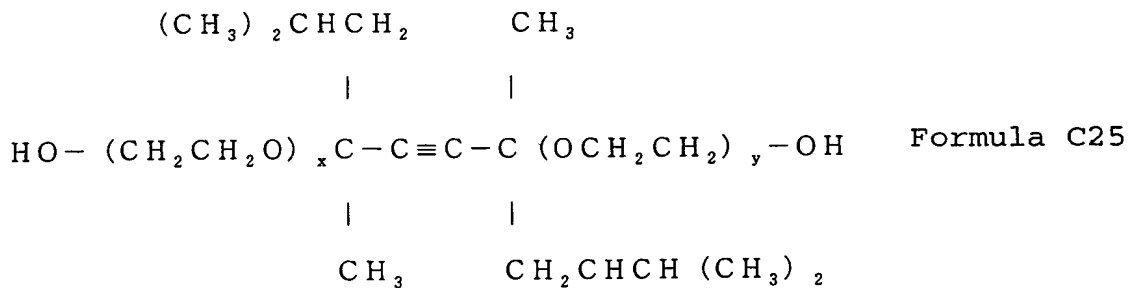


k is respectively at least 2, A<sup>1</sup>, A<sup>2</sup> and A<sup>3</sup> may be respectively one kind or a combination of two or more kinds.

R<sup>11</sup> to R<sup>16</sup> are respectively independently a hydrogen atom or an alkyl group. The alkyl group is preferably an alkyl group having a carbon number of from 1 to 12, more preferably an alkyl group having a carbon number of from 1 to 4. Examples of the alkyl group include a methyl group, an ethyl group, a propyl group, a butyl group, and an isobutyl group.

The POA chain is preferably a POE chain, a POP chain or a chain containing a POE chain and a POP chain. A repeating unit number of the POA chain is preferably from 1 to 50.

The surfactant c<sup>2</sup> is preferably a nonionic surfactant expressed by the following formula C<sup>25</sup>, wherein x and y are respectively 0 or an integer of from 1 to 30. A nonionic surfactant expressed by the formula C<sup>25</sup> may be one kind or a combination of two or more kinds.

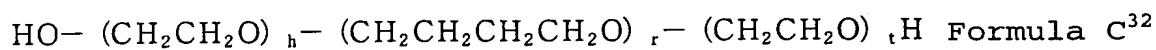
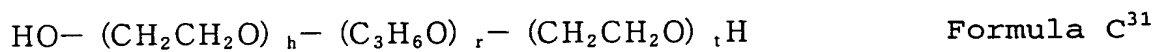


The nonionic surfactant of the formula C<sup>25</sup> is preferably a nonionic surfactant, wherein x and y are 0,

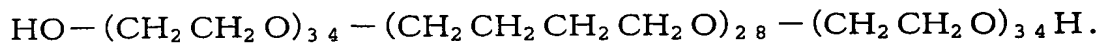
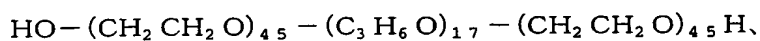
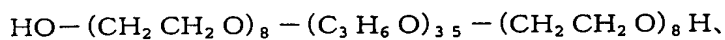
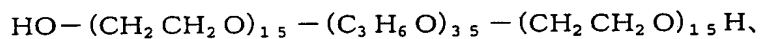
the total of x and y is averagely from 1 to 4, or the total of x and y is averagely from 10 to 30.

A POA chain having a carbon number of at least 3 in the surfactant  $c^3$  is preferably polyoxytetramethylene (hereinafter referred to as "POT") and/or a POP chain.

The surfactant  $c^3$  is preferably a nonionic surfactant expressed by the following formula  $C^{31}$  or  $C^{32}$ , wherein h is 0 or an integer of from 1 to 200, r is an integer of from 2 to 100, and t is 0 or an integer of from 1 to 200. When h is 0, t is an integer of at least 2, and when t is 0, h is an integer of at least 2. The unit  $-C_3H_6O-$  may be  $-CH(CH_3)CH_2-$ ,  $-CH_2CH(CH_3)-$  or a mixture of  $-CH(CH_3)CH_2-$  and  $-CH_2CH(CH_3)-$ . The POA chain is block-like.



Examples of the surfactant  $c^3$  include the following compounds.



The surfactant  $c^4$  is preferably a nonionic surfactant expressed by the following formula  $C^{41}$ .



In the above formula,  $R^{17}$ ,  $R^{18}$  and  $R^{19}$  are respectively independently a monovalent hydrocarbon group.

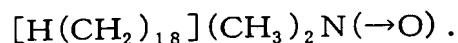
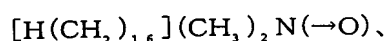
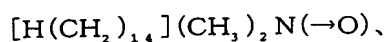
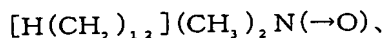
In the present invention, a surfactant having an amine oxide ( $N \rightarrow O$ ) group is handled as a nonionic surfactant. The surfactant  $c^4$  may be one kind or a combination of two or more kinds.

5 In view of dispersion stability of the polymer (A), the surfactant  $c^4$  is preferably a nonionic surfactant expressed by the following formula  $C^{42}$ .



10 In the above formula,  $R^{20}$  is a  $C_6$ - $C_{22}$  alkyl group, a  $C_6$ - $C_{22}$  alkenyl group, a phenyl group having an alkyl group (carbon number=6-22) bonded or a phenyl group having an alkenyl group (carbon number=6-22) bonded, and a  $C_8$ - $C_{22}$  alkyl group or a  $C_8$ - $C_{22}$  alkenyl group is preferable.

15 Examples of the nonionic surfactant expressed by the formula  $C^{42}$  include the following compounds.



20 A substituted phenyl group in the surfactant  $c^5$  is preferably a phenyl group substituted with a monovalent hydrocarbon group, more preferably a phenyl group substituted with an alkyl group, an alkenyl group or a styryl group.

25 Preferable examples of the surfactant  $c^5$  include polyoxyethylene mono(alkylphenyl)ether condensate, polyoxyethylene mono(alkenylphenyl)ether condensate,

polyoxyethylene mono(alkylphenyl)ether, polyoxyethylene mono(alkenylphenyl)ether or polyoxyethylene mono[(alkyl)(styryl)phenyl]ether.

Examples of the polyoxyethylene mono(substituted phenyl)ether condensate or the polyoxyethylene mono(substituted phenyl)ether include polyoxyethylene mono(nonylphenyl)ether-formaldehyde condensate, polyoxyethylene mono(nonylphenyl)ether, polyoxyethylene mono(octylphenyl)ether, polyoxyethylene mono(oleylphenyl)ether, polyoxyethylene mono[(nonyl)(styryl)phenyl]ether, polyoxyethylene mono[(oleyl)(styryl)phenyl]ether, and the like.

A polyol in the surfactant c<sup>6</sup> is glycerin, sorbitan, sorbit, polyglycerin, polyethylene glycol, polyoxyethylene glyceryl ether, polyoxyethylene sorbitan ether or polyoxyethylene sorbit ether.

Examples of the surfactant c<sup>6</sup> include 1:1 (mol ratio) ester of octadecanoic acid and polyethylene glycol, 1:4 (mol ratio) ester of sorbit-polyethylene glycol ether and oleic acid, 1:1 (mol ratio) ester of polyoxyethylene glycol-sorbitan ether and octadecanoic acid, 1:1 (mol ratio) ester of polyethylene glycol-sorbitan ether and oleic acid, 1:1 (mol ratio) ester of dodecanoic acid and sorbitan, 1:1 or 2:1 (mol ratio) ester of oleic acid and decaglycerin, 1:1 or 2:1 (mol ratio) ester of octadecanoic acid and decaglycerin, and the like.

In the present invention, when the surfactant (C)

contains a cationic surfactant  $C^7$ , it is preferable to use a cationic surfactant in a substituted ammonium salt form. The cationic surfactant in a substituted ammonium form is preferably an ammonium salt, in which at least one hydrogen atom bonded to a nitrogen atom is substituted with an alkyl group, an alkenyl group or a POA chain having a hydroxyl group at the terminal, and is more preferably a compound expressed by the following formula  $C^{71}$ .



In the above formula,  $R^{21}$  is a hydrogen atom, a  $C_1$ - $C_{22}$  alkyl group, a  $C_2$ - $C_{22}$  alkenyl group or a POA chain having a hydroxyl group at the terminal, and four  $R^{21}$  may be the same or different, but at least one of  $R^{21}$  is an alkyl group.  $X^-$  is a pair ion.

R<sup>21</sup> is preferably a long chain alkyl group having a carbon number of from 6 to 22 or a long chain alkenyl group having a carbon number of from 6 to 22. When R<sup>21</sup> is an alkyl group other than a long chain alkyl group, a methyl group or an ethyl group is preferable. When R<sup>21</sup> is a POA group, a POE group is preferable. X<sup>-</sup> is preferably a chlorine ion, an ethylsulfuric acid ion or an acetic acid ion.

Examples of the compound expressed by the formula  $C^{71}$  include monooctadecyltrimethylammonium chloride, monooctadecyldimethylmonoethylammonium ethylsulfate, mono(octadecyl)monomethyldi(polyethylene glycol)ammonium

chloride, di(tallow oil alkyl)dimethylammonium chloride, dimethylmonococonutamine acetate, and the like.

In the present invention, when the surfactant (C) contains an amphoteric surfactant  $c^8$ , a preferable  
5 amphoteric surfactant is in a form of alanines, imidazorinium betaines, amidebetaines or acetic acid betaines. Examples of the amphoteric surfactant  $c^8$  include dodecylbetaine, octadecylbetaine, dodecylcarboxymethylhydroxyethylimidazoriniumbetaine,  
10 dodecyldimethylaminoacetic acid betaine, aliphatic acid amidepropyldimethylaminoacetic acid betaine, and the like.

A content of the surfactant (C) is preferably polymer (A)/surfactant (C)=100/1-10, more preferably 100/3-8 at a mass ratio. When the content of the  
15 surfactant (C) is too small, stability of emulsion is lowered, and when the content of the surfactant (C) is too large, durability of water- and oil-repellent performance is lowered and dye fastness is damaged.

When a cationic surfactant  $c^7$  and/or an amphoteric  
20 surfactant  $c^8$  are used as the surfactant (C), it is preferable to use nonionic surfactants  $c^1$  to  $c^6$  in combination therewith. A content of the cationic surfactant and/or the amphoteric surfactant is preferably polymer (A)/cationic surfactant=100/0.1 to 2 at a mass  
25 ratio and polymer (A)/amphoteric surfactant=100/0.1 to 2. If the content of the cationic surfactant and/or the amphoteric surfactant is too large, a combination use

effect with a dyeing processing assistant is lowered.

Examples of a method for preparing the polymer (A) of the present invention include a bulk polymerization method, a solution polymerization method, a suspension  
5 polymerization method, an emulsion polymerization method and the like, but an emulsion polymerization method is preferable. In the emulsion polymerization method, it is preferable to copolymerize monomer  $a^1$ , monomer  $a^2$ , monomer  $a^3$  and monomer  $a^4$  in the presence of a surfactant  
10 (C) in an aqueous medium having a polymerization initiator and a chain transfer agent added thereto.

The polymerization initiator is preferably a water-soluble or oil-soluble polymerization initiator, and a commonly used initiator such as an azo type initiator, a  
15 peroxide type initiator or a redox type initiator is used depending on a polymerization temperature. As the polymerization initiator, a water-soluble initiator is preferable, and particularly a water-soluble salt of an azo type compound is more preferable. The polymerization  
20 temperature is not specially limited, but is preferably from 20 to 150°C.

The chain transfer agent is preferably an aromatic type compound or mercaptans, and alkylmercaptans are more preferable. Examples of the chain transfer agent include  
25 octyl mercaptan, dodecyl mercaptan, tert-dodecyl mercaptan, stearyl mercaptan or  $\alpha$ -methylstyrene dimmer  $\text{CH}_2=\text{CPhCH}_2\text{C}(\text{CH}_3)_2\text{Ph}$  (wherein Ph is a phenyl group), and

the like.

In the present invention, before starting emulsion polymerization, it is preferable to have a mixture of a monomer, a surfactant and an aqueous medium subjected to mixing and dispersing (which may be referred to as "pre-emulsifying") by a homomixer or a high pressure emulsifier. When a polymerization mixture is previously subjected to mixing and dispersing before starting polymerization, a polymerization yield of a finally obtained polymer (A) is preferably improved.

The polymer (A) is preferably dispersed as particles in an aqueous medium. The polymer (A) dispersed in the aqueous medium has an average particle size of preferably from 10 to 1000 nm, more preferably from 10 to 300 nm, most preferably from 10 to 200 nm. If the average particle size is less than 10  $\mu\text{m}$ , it is necessary to use a large amount of surfactant in order to obtain a stable dispersion, and water- and oil-repellency of the treated material is lowered and crocking of color of dyed clothes is caused. When the average particle size exceeds 1000 nm, dispersed particles are not stable and are settled in the aqueous medium. The average particle size is measured by a dynamic light scattering apparatus, an electron microscope or the like.

The water- and oil-repellent composition of the present invention may contain various additives. These additives are different from the polymer (A), examples of



which include a polymer extender, a water-repellent, an oil-repellent, a crosslinking agent, an antistatic agent, a dye stabilizer, an anti-creasing agent, a stain blocker, a flame-retardant, a moth-proofing agent, and the like.

5        It is preferable that the water- and oil-repellent composition of the present invention does not contain a polymer containing a polymerization unit having an organic halogen atom (except for a fluorine atom) and/or an organic halogen compound (except for an organic  
10    fluorine compound).

      A solid content of the water- and oil-repellent composition of the present invention is preferably from 10 to 40 mass%, more preferably from 15 to 30 mass%, in view of preservation stability of emulsion,  
15    transportation cost or the like.

      Examples of a material to be treated by the water- and oil-repellent composition of the present invention include textile fabrics such as single fiber, complex fiber, cloth, carpet or the like, leather products such  
20    as fur, paper, wood, plastics, glass, metal, metal oxide, asbestos, brick, cement, and other ceramics, and a particularly preferable example includes textile fabrics.

      Examples of textile fabrics include natural fibers such as cotton, hemp, wool, silk or the like, synthetic  
25    fibers such as polyamide, polyester, polyvinyl alcohol, polyacrylonitrile, polyvinyl chloride, polypropylene or the like, semi-synthetic fibers such as rayon, acetate or

the like, inorganic fibers such as glass fiber, carbon fiber, asbestos fiber or the like, or their mixed fiber fabrics.

The water- and oil-repellent composition of the present invention is diluted to an optional concentration depending on its objects or uses, and is coated on a material to be treated. An optional method can be employed as a coating method applied to a material to be coated, depending on a kind of the material to be treated, a preparation style of the composition or other conditions. For example, when employing a dip-coating method, a material to be treated is dipped in a diluted solution of the water- and oil-repellent composition, and the coated material thus treated is dried. At the time of dipping, it may be preferable to use an appropriate crosslinking agent if necessary, and to carry out a curing treatment at a high temperature.

For example, when treating textile fabrics such as nylon, polyester, cotton or the like for clothes, a non-volatile content concentration is preferably from 0.1 to 3 mass%, more preferably from 0.5 to 2 mass%, in order to achieve an appropriate water- and oil-repellency while maintaining a satisfactory hand feeling of fabrics and to obtain an economical advantage. Also, in order to form a film of the water- and oil-repellent composition on the surface of fibers and to be fully adhered thereto, it is preferable to carry out a heat treatment including drying

and curing at 80 to 200°C for 30 to 300 seconds.

The water- and oil-repellent composition of the present invention can impart water- and oil-repellency excellent in durability to a material to be treated, and  
5 does not make the treated material yellowish and does not cause crude hardening of hand feeling of the treated material. Also, as compared with a conventional method, a processing method is convenient, and a processing bath is excellent in stability, easy handling and economical  
10 viewpoint.

#### EXAMPLES

The present invention is further illustrated with reference to the following Polymerization Examples and Working Examples, but should not be limited thereto.  
15 Examples 1 to 5 are Examples of the present invention and Examples 6 to 17 are Comparative Examples. Also, preparation of a treating solution for processing, preparation of a cloth for evaluating water- and oil-repellency, evaluation of stability of a processing bath,  
20 evaluation of water-repellency, evaluation of oil-repellency, evaluation of washing resistance, evaluation of yellow coloring and evaluation of hand feeling were made by the following methods.

(Preparation of treating solution for processing)

25 A treating solution for processing was prepared by adjusting a water- and oil-repellent composition with tap water in such a manner as to make a non-volatile content

concentration 1 mass%. As Comparative Examples, two treating solutions were prepared in the same manner as above by using a commercially available fluorine type water- and oil-repellent, a methylol melamine type resin (crosslinking agent) and its catalyst, and by using a commercially available fluorine type water- and oil-repellent and a commercially available blocked isocyanate type crosslinking agent (resin).

(Preparation of cloth for evaluating water- and oil-repellency)

An undyed mercerized cotton (100%) broadcloth was dipped in a treating solution, and the wet cloth thus dipped was subjected to squeezing between two rubber rollers in such a manner as to make a wet pickup 70 mass%. The cloth thus treated was dried at 110°C for 60 seconds, and was then heat-treated at 170°C for 90 seconds to prepare a test cloth. Also, when employing a dyed nylon Taslan cloth treated with a fixing agent, a test cloth was prepared in the same manner as in the above cotton (100%) broadcloth, except that a wet pickup was made 60 mass%.

(Evaluation of stability of processing bath)

A test solution for evaluation was prepared in the same manner as in the above processing solution. 100 mL of each test solution for evaluation was placed in a glass-made sample bottle, and was allowed to stand in a constant temperature tester at 40°C, and after 24 hours,

a state of the test solution was visually valuated.

(Evaluation of water-repellency)

Spraying test of JIS-L1092 1992 was carried out, and results were shown by water repellency numbers as  
5 illustrated in the following Table 1. Intermediate evaluation results between water repellency numbers were evaluated by attaching marks + and -, and + means a better result and - means a worse result.

Table 1

Water-repellency No.	State
100	No wet surface
90	Slightly wet surface
80	Partly wet surface
70	Wet surface
50	Whole wet surface
0	Completely wet surface on both front and back sides

10

(Evaluation of oil-repellency)

Oil-repellency test was carried out in accordance with AATCC-Test Method 118-1997, and results were shown by oil-repellency numbers as illustrated in the following  
15 Table 2.

Table 2

Oil-repellency No.	Test solution	Surface tension mN/m (25°C)
8	n-heptane	20.0
7	n-octane	21.8
6	n-decane	23.5
5	n-dodecane	25.0
4	n-tetradecane	26.7
3	n-hexadecane	27.3
2	Nujol 65 parts /hexadecane 35 parts	29.6
1	Nujol	31.2
0	Less than 1	—

(Evaluation of washing resistance)

In accordance with JIS L1091:1998 5.2a)3) C method,  
 5 a cotton broadcloth was washed in such a manner as to correspond to five times of domestic washing and a nylon Taslan cloth was washed in such a manner as to correspond to ten times of domestic washing (respectively referred to as "HL-5" and "HL-10"). The washing was carried out  
 10 by using an all automatic repeating type washing tester AWS-30 manufactured by Daiei Kagaku Seiki K.K. and a washing detergent of "Attack" manufactured by Kao K.K. After washing, the washed cloth was dried in air and heat-dried by a pin stenter for testing. The drying in  
 15 air was carried out at a temperature of 25°C and at a

moisture of 60%RH for one night. The heat-drying was carried out at 75°C for 5 minutes. Water-repellency and oil-repellency were evaluated before and after washing. With regard to the washed clothes, water-repellency and oil-repellency were evaluated after drying in air and after heat-drying (drying at 75°C for 5 minutes).

(Evaluation of yellowing)

An undyed mercerized cotton (100%) broadcloth was treated in the same manner as in the cloth used for evaluating water-repellency and oil-repellency, and color change of the cloth was visually evaluated.

(Evaluation of hand feeling)

An undyed mercerized cotton (100%) broadcloth and a dyed nylon taffeta cloth treated with a fixing agent were treated in the same manner as in the cloth used for evaluating water-repellency and oil-repellency, and hand feeling of the cloth was evaluated by a functional test, and the results were evaluated by five ranks as shown in the following Table 3.

Table 3

Evaluation	Hand feeling
5	Softer hand feeling than untreated cloth
4	Somewhat softer hand feeling than untreated cloth
3	Same as untreated cloth
2	Somewhat harder hand feeling than untreated cloth
1	Harder hand feeling than untreated cloth

(Polymerization Example)

158.7 g of perfluoroalkylethyl acrylate  
( $F(CF_2)_nCH_2CH_2OCOCH=CH_2$ , mixture of  $n=6-16$ , average value  
of  $n=9$ , purity 93.6 mass%, hereinafter referred to as  
"FA"), 97.2 g of butyl methacrylate, 13.5 g of stearyl  
5 acrylate, 10.8 g of 2-isocyanate ethyl methacrylate, the  
isocyanate group of which is blocked with 2-butanone  
oxime, 0.8 g of dodecyl mercaptan (DoSH), 10.8 g of  
polyoxyethyleneoleyl ether (average addition mol number  
of ethylene oxide=30) (Nonion E230 manufactured by NOF  
10 Corporation), 1.4 g of polyoxyethylene-polyoxypropylene  
block copolymer (Pronon 204 manufactured by NOF  
Corporation), 1.4 g of 4,7-bispolyoxyethyleneoxy-2,4,7,9-  
tetramethyl-5-decyne (Surfynol 485 manufactured by Air  
Products and Chemical Inc.), 4.3 g of stearyl  
15 trimethylammonium chloride (purity=63%), 108 g of  
dipropylene glycol, 389.9 g of ion exchanged water and  
1.9 g of acetic acid were placed in a 1 L glass-made  
beaker.

The beaker was heated at 50°C in a hot water bath,  
20 and the content was mixed by a homomixer (TK homomixer  
MK2 manufactured by Tokushu Kika K.K.) to obtain a mixed  
solution. The mixed solution was emulsified under a  
pressure of 40 MPa by a high pressure emulsifying machine  
(LAB60-10TBS manufactured by APV Gholin K.K.) while  
25 maintaining at 50°C.

698.8 g of the emulsified solution thus obtained was  
placed in a 1L autoclave, and was cooled to at most 30°C.



1.2 g of 2,2'-azobis[2-(2-imidazolin-2-yl)propane] (VA-061 manufactured by Wako Pure Chemical Industries, Ltd.) was added thereto, and air phase was substituted with nitrogen. The resultant mixture was polymerized for 8  
5 hours by heating to 60°C while stirring, thus obtaining a milk white emulsion.

The emulsion thus obtained was filtrated under pressure by a filter paper (C-63 manufactured by Advantec Co., Ltd.). The emulsion filtrated under pressure was  
10 dried at 120°C for 4 hours, and a non-volatile content concentration (hereinafter referred to as "solid content concentration") was 35.0 mass% and an average particle size of dispersion particles measured by a dynamic light scattering particle size-measuring apparatus (ELS-800  
15 manufactured by Otsuka Electronics Co., Ltd.) was 125 nm. The emulsion was adjusted by ion exchanged water so as to provide a concentration of 20%, thus obtaining a water- and oil-repellent composition.

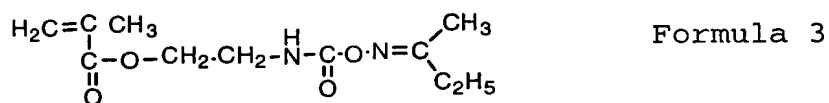
(POLYMERIZATION EXAMPLES 2 to 9)

20 By using starting material compositions as shown in the following Table 4 or 5, water- and oil-repellent compositions 2 to 9 were obtained in the same manner as in the above Polymerization Example 1. Abbreviations of starting materials are illustrated below.

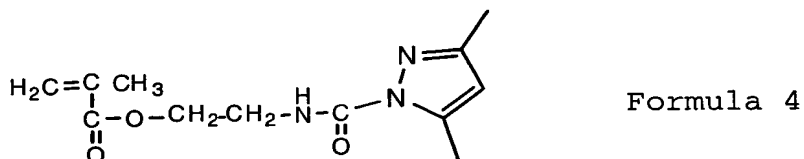
25 FA: The above perfluoroalkylethyl acrylate,  
BMA: Butyl methacrylate,  
StA: Stearyl acrylate,

VMA-70: Mixture of stearyl methacrylate and behenyl methacrylate (Blenmer VMA-70 manufactured by NOF Corporation),

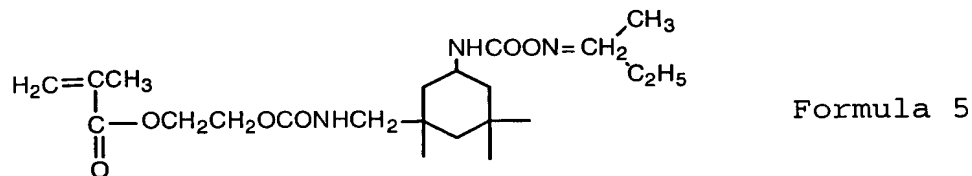
MOI-BM: 2-Isocyanate ethyl methacrylate, the  
5 isocyanate group of which is blocked with 2-butanone oxime (compound of the following formula 3),



MOI-PY: 2-Isocyanate ethyl methacrylate, the  
10 isocyanate group of which is blocked with 3,5-dimethylpyrazole (compound of the following formula 4),



VI-VM: 1,3,3-Trimethyl-4-  
isocyanatecyclohexylmethoxymethyl methacrylate, the  
15 isocyanate group of which is blocked with 2-butanone oxime (compound of the following formula 5),



BMAA: N-butoxymethylacrylamide,

20 P204: Polyoxyethylene-polyoxypropylene block

copolymer (Pronon 204 manufactured by NOF Corporation),

E230: Polyoxyethylene oleyl ether (average addition  
mol number of ethylene oxide=30) (Nonion E230  
manufactured by NOF Corporation),

5 S485: 4,7-Bispolyoxyethylene-2,4,7,9-tetramethyl-5-  
decyne (Surfynol 485 manufactured by Air Products and  
Chemical Inc.),

STMAC: Stearyltrimethylammonium chloride,

SLS: Sodium laurylsulfate,

10 DPG: Dipropylene glycol,

DoSH: Normal-dodecyl mercaptan,

VA-061: 2,2'-azobis[2-(2-imidazolin-2-yl)propane]  
(manufactured by Wako Pure Chemical Industries, Ltd.),  
and

15 V-501: 4,4'-Azobis(4-cyanovaleric acid)  
(manufactured by Wako Pure Chemical Industries, Ltd.).

Table 4

Starting material	Polymerization Example 1	Polymerization Example 2	Polymerization Example 3	Polymerization Example 4	Polymerization Example 5
FA	158.7	158.7	158.7	158.7	158.7
BMA	97.2	91.8	91.8	91.8	91.8
StA	13.5	13.5	13.5	—	—
VMA-70	—	—	—	—	13.5
GMA	—	5.4	5.4	5.4	5.4
MOI-BM	10.8	10.8	—	—	—
MOI-py	—	—	10.8	—	—
VI-BM	—	—	—	10.8	—
BMAA	—	—	—	—	—
P204	1.4	1.4	1.4	1.4	1.4
E230	10.8	10.8	10.8	10.8	10.8
S485	1.4	1.4	1.4	1.4	1.4
STMAC	4.3	4.3	4.3	4.3	4.3
SLS	—	—	—	—	—
Na <sub>2</sub> CO <sub>3</sub>	—	—	—	—	—
Acetic acid	1.9	1.9	1.9	1.9	1.9
DPG	108	108	108	108	108
Water	389.9	389.9	389.9	389.9	389.9
D <sub>2</sub> O SH	0.8	0.8	0.8	0.8	0.8
VA-061	1.2	1.2	1.2	1.2	1.2
V-501	—	—	—	—	—
Particle size (μm)	125	132	140	115	151

Table 5

Starting material	Polymeri- zation Example 6	Polymeri- zation Example 7	Polymeri- zation Example 8	Polymeri- zation Example 9
FA	158.7	158.7	158.7	159.0
BMA	105.3	—	91.8	91.9
StA	—	105.3	13.5	13.5
VMA-70	—	—	—	—
GMA	5.4	5.4	5.4	5.4
MOI-BM	10.8	10.8	—	10.8
MOI-py	—	—	—	—
VI-BM	—	—	—	—
BMAA	—	—	10.8	—
P204	1.4	1.4	1.4	1.4
E230	10.8	10.8	10.8	10.8
S485	1.4	1.4	1.4	1.4
STMAC	4.3	4.3	4.3	—
SLS	—	—	—	2.7
Na <sub>2</sub> CO <sub>3</sub>	—	—	—	0.7
Acetic acid	1.9	1.9	1.9	1.9
DPG	108	108	108	108
Water	389.9	389.9	389.9	392.1
DOSH	0.8	0.8	0.8	0.8
VA-061	1.2	1.2	1.2	—
V-501	—	—	—	1.2
Particle size( $\mu$ m)	125	263	180	204

## EXAMPLE 1

The water- and oil-repellent composition obtained in  
 5 the above Polymerization Example 1 was evaluated with  
 respect to processability, stability in a processing bath,

water-repellency, oil-repellency, washing resistance, yellowing and hand feeling in accordance with such prescriptions as shown in the following Table 6. The results are shown in the following Tables 7 to 9.

5   EXAMPLES 2 to 17

          The water- and oil-repellent compositions as shown in the following Table 6 were evaluated with respect to processability, stability in a processing bath, water-repellency, oil-repellency, washing resistance, yellowing  
10 and hand feeling in accordance with such prescriptions as shown in Table 6. The results are shown in the following Tables 7 to 9. Commercially available water- and oil-repellents used in Comparative Examples are illustrated below.

15       AG-480: Fluorine type water- and oil-repellent (containing organic chlorine) having a solid content concentration of 20%, Asahiguard AG-480 manufactured by Asahi Glass Company, Limited,

          TG-561: Fluorine type water- and oil-repellent  
20 (containing organic chlorine) having a solid content concentration of 30%, Unidyne TG-561 manufactured by Daikin Industries, Ltd.,

          M-3: Trimethylolmelamine type crosslinking agent, Sumitex Resin M-3 manufactured by Sumitomo Chemical Co.,  
25 Ltd.,

          Catalyst: Organic amine type catalyst for melamine resin, Sumitex accelerator manufactured by Sumitomo

Chemical Co., Ltd., and

PB-11: Commercially available blocked isocyanate crosslinking agent, Meikanate PB-11 manufactured by Meisei Kagaku Kogyo K.K.

5 Table 6

	Water- and oil-repellent composition		M-3/ Catalyst	BP-11
	Kind	Concen- tration	Concen- tration	Concen- tration
Ex. 1	Polymerization Ex. 1	1%	—	—
Ex. 2	Polymerization Ex. 2	1%	—	—
Ex. 3	Polymerization Ex. 3	1%	—	—
Ex. 4	Polymerization Ex. 4	1%	—	—
Ex. 5	Polymerization Ex. 5	1%	—	—
Ex. 6	Polymerization Ex. 6	1%	—	—
Ex. 7	Polymerization Ex. 7	1%	—	—
Ex. 8	Polymerization Ex. 8	1%	—	—
Ex. 9	Polymerization Ex. 9	1%	—	—
Ex. 10	Polymerization Ex. 8	1%	0.3%/0.3%	—
Ex. 11	Polymerization Ex. 8	1%	—	2%
Ex. 12	AG-480	1%	—	—
Ex. 13	AG-480	1%	0.3%/0.3%	—
Ex. 14	AG-480	1%	—	2%
Ex. 15	TG-561	1%	—	—
Ex. 16	TG-561	1%	0.3%/0.3%	—
Ex. 17	TG-561	1%	—	2%

Table 7

	Water- and oil-repellent composition	Water-repellency/oil-repellency, cotton broadcloth		
		Initial stage	HL-5 after drying in air	HL-5 after drying at 75°C
Ex. 1	Polymerization Ex. 1	100/5	70 <sup>+</sup> /2	80/2
Ex. 2	Polymerization Ex. 2	100/5	80 <sup>-</sup> /2	80 <sup>+</sup> /3
Ex. 3	Polymerization Ex. 3	100/5	70 <sup>+</sup> /2	80 <sup>+</sup> /2
Ex. 4	Polymerization Ex. 4	100/5	70/1	80 <sup>-</sup> /2
Ex. 5	Polymerization Ex. 5	100/4	70 <sup>+</sup> /2	80/2
Ex. 6	Polymerization Ex. 6	100 <sup>-</sup> /4	70 <sup>-</sup> /1	70 <sup>+</sup> /1
Ex. 7	Polymerization Ex. 7	100 <sup>-</sup> /4	70 <sup>-</sup> /0	70/1
Ex. 8	Polymerization Ex. 8	100 <sup>-</sup> /4	50/1	70 <sup>-</sup> /1
Ex. 9	Polymerization Ex. 9	70/2	50/0	70 <sup>-</sup> /1
Ex. 11	Polymerization Ex. 8	100/4	70 <sup>+</sup> /2	80/2
Ex. 12	AG-480	100/4	50/0	50 <sup>+</sup> /0
Ex. 14	AG-480	100/4	80 <sup>-</sup> /2	90/2
Ex. 15	TG-561	100/5	50/1	50 <sup>+</sup> /1
Ex. 17	TG-561	100 <sup>-</sup> /5	70/2	80/2



Table 8

	Water- and oil-repellent composition	Water-repellency/oil-repellency, nylon Taslan cloth		
		Initial stage	HL-10 after drying in air	HL-10 after drying at 75°C
Ex. 1	Polymerization Ex. 1	100/5	70/3	100 <sup>-</sup> /4
Ex. 2	Polymerization Ex. 2	100/5	70/3	100 <sup>-</sup> /4
Ex. 3	Polymerization Ex. 3	100/5	70/3	100 <sup>-</sup> /4
Ex. 4	Polymerization Ex. 4	100/5	70/2	80 <sup>+</sup> /3
Ex. 5	Polymerization Ex. 5	100/4	70/2	90/4
Ex. 6	Polymerization Ex. 6	100/4	70 <sup>-</sup> /3	80 <sup>+</sup> /3
Ex. 7	Polymerization Ex. 7	100/4	70 <sup>-</sup> /1	80/2
Ex. 8	Polymerization Ex. 8	100/5	50/0	50 <sup>+</sup> /0
Ex. 9	Polymerization Ex. 9	80/2	0/0	50/0
Ex. 10	Polymerization Ex. 8	100/5	80/2	90/3
Ex. 11	Polymerization Ex. 8	100/5	70/1	80 <sup>+</sup> /3
Ex. 12	AG-480	100/4	50/0	50/1
Ex. 13	AG-480	100/5	80/3	100 <sup>-</sup> /3
Ex. 14	AG-480	100/4	70/2	80 <sup>+</sup> /3
Ex. 15	TG-561	100/5	50/0	50 <sup>+</sup> /0
Ex. 16	TG-561	100/5	90/3	100 <sup>-</sup> /4
Ex. 17	TG-561	100/5	70/3	90 <sup>-</sup> /4

Table 9

	Water- and oil-repellent composition	Presence or absence of yellowing	Hand feeling	Stability in a processing bath
Ex. 1	Polymerization Ex. 1	Absent	4	No change
Ex. 2	Polymerization Ex. 2	Absent	3	No change
Ex. 3	Polymerization Ex. 3	Absent	3	No change
Ex. 4	Polymerization Ex. 4	Absent	3	No change
Ex. 5	Polymerization Ex. 5	Absent	3	No change
Ex. 6	Polymerization Ex. 6	Absent	3	No change
Ex. 7	Polymerization Ex. 7	Absent	2	No change
Ex. 8	Polymerization Ex. 8	Absent	3	No change
Ex. 9	Polymerization Ex. 9	Absent	3	Cloudy
Ex. 10	Polymerization Ex. 8	Absent	2	Cloudy
Ex. 11	Polymerization Ex. 8	Present	2	Partly settling
Ex. 12	AG-480	Absent	4	No change
Ex. 13	AG-480	Absent	2	Cloudy
Ex. 14	AG-480	Present	2	Partly settling
Ex. 15	TG-561	Absent	2	No change
Ex. 16	TG-561	Slightly present	1	Partly settling
Ex. 17	TG-561	Present	1	Partly settling

The entire disclosure of Japanese Patent Application No. 2001-127977 filed on April 25, 2001 including  
specification, claims and summary is incorporated herein  
5 by reference in its entirety.